SFB/TRR 21 - Seminar

27. Februar 2015, Tübingen

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Towards quantum physics with levitated, micrometer-sized superconducting spheres

Mechanical oscillators are known to be sensitive devices to measure small forces and therefore widely used in (classical) sensing applications. More recently, mechanical oscillators have found their way into quantum physics and quantum information. This has been pioneered by coupling them to light in a cavity, which gave birth to the field of cavity optomechanics [1]. Landmark experiments include for example the preparation of mechanical ground states [2], strong coupling between light and mechanical oscillators [3] and entanglement generation [4].
Ultimately, mechanical oscillators could be used to test quantum physics in a new parameter regime of large mass and long coherence time. A recent experimental proposal promises to enter this regime by levitating a superconducting sphere in a magnetic field and coupling its center of mass motion to superconducting circuits [5]. In my talk, I will give an introduction to the field of cavity optomechanics and introduce our current experimental work on levitated superconducting spheres.
[1] M. Aspelmeyer, T. J. Kippenberg, F. Marquardt, Rev. Mod. Phys. 86, 1391 (2014) [2] Chan et al., Nature 478, 89 (2011); Teufel et al., Nature 475, 359 (2011); A. D. O'Connell et al., Nature 464, 697 (2010) [3] Gröblacher et al., Nature 460, 724 (2009); Teufel et al., Nature 471, 204 (2011); Verhagen et al., Nature 482, 63 (2012) [4] T. A. Palomaki et al., Science 342, 710 (2013) [5] O. Romero-Isart et al., Phys. Rev. Lett. 109, 147205 (2012); M. Cirio et al., Phys. Rev. Lett. 109, 147206 (2012)

27. Februar 2015, 10:15 Uhr

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